


This Report has been cleared for submission to the Director/Board by Warren Phelan, Programme Manager.

Signed: Warren Phelan

Dated: 17<sup>th</sup> of May 2022

		<b>OFFICE OF ENVIRONMENTAL SUSTAINABILITY</b>	
<b>INSPECTOR'S REPORT ON AN APPLICATION FOR A CERTIFICATE OF AUTHORISATION FOR A CLOSED LANDFILL</b>			
<b>TO:</b>	Director		
<b>FROM:</b>	Ewa Babiarczyk, Inspector,	Environmental Licensing Programme	
<b>DATE:</b>	18 <sup>th</sup> May 2022		
<b>RE:</b>	Application by <b>Galway County Council</b> for a Certificate of Authorisation for a closed landfill at <b>Galway County Council Roads Depot, Tullyvoheen, Clifden, County Galway.</b> Certificate of Authorisation Register Number <b>H0176-01.</b>		

## 1. Application details

Type of facility:	Closed landfill as defined in the Regulations <sup>1</sup> .
Original site ownership	Private ownership.
Current site ownership	Private ownership.
Operator of closed landfill	Galway County Council has operated this site since 1984.
Proposed use post remedial works	The site is intended to continue to be used by Galway County Council as a road depot.
Risk category of closed landfill:	High risk (class A) due to <ul style="list-style-type: none"><li>Migration of landfill leachate into surface waters.</li></ul>
Section 22 register number:	S22-02237
Grid Reference	67631.1 E 251185 N (ING)

<sup>1</sup> Waste Management (Certification of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008 (S.I. No. 524 of 2008).

Application received:	16 <sup>th</sup> July 2020
AA screening determination:	25 <sup>th</sup> January 2021
Publication date for Notice for Public Consultation on Appropriate Assessment:	18 <sup>th</sup> October 2021
No of Submissions or Observations on Appropriate Assessment:	There were no Submissions or Observations received.
Regulation 7(4) notice:	29 <sup>th</sup> January 2021, 7 <sup>th</sup> April 2021 and 15 <sup>th</sup> July 2021.
Additional information received:	Applicant: Regulation 7(4) Reply received on 26 <sup>th</sup> February 2021, 6 <sup>th</sup> May 2021 and 16 <sup>th</sup> September 2021. Third party: 13 <sup>th</sup> April 2022.
Name of Qualified Person:	Padraic Mulroy, Credentials provided by Engineers Ireland.
EPA site inspection:	No inspection was required.

## 2. Information on the closed landfill

Location of facility	The closed landfill is located in a glacial valley 1.7km north-east of the centre of Clifden town, County Galway.  The location of the landfill site is shown in Figure 1.
Period of landfilling	1984 to c. 1996.
Surrounding area	The site is located in a rural and remote area. A narrow road runs along the northern boundary of the site, as shown in Figure 2 and the Cashleen Lough (Lake Id 32_258) is located 630m east of the site. From this lake, an unnamed stream traverses the site (waterbody code: IE_WE_32O030300, segment code: 32_2924) in a westerly direction, as shown in Figure 1. The Nambrackkeagh Lough (Lake Id 32_422), is located 360m north-west of the site.  There are no buildings in close proximity to the site. The nearest domestic dwelling is located approximately 400m south-west of the landfill, as shown in Figure 1.  The Clifden Waste Water Treatment Plant (Licence Reg. No. D0198-01) is located 2.3km south-west of the site and a discharge point from a hotel, authorised under Section 4 of the Water Pollution Acts (Local Authority Reference Number W081/78), is located 2.4km south-west of the site, as shown in Figure 1.
Area of the closed	The site covers an area of 1.27 ha.

landfill	
Quantity of waste at the facility	Approximately 205,000 tonnes. 114,000 m <sup>3</sup> .
Characterisation of waste deposited	The waste comprises municipal waste, construction & demolition (C&D) waste and commercial waste. Domestic black bag waste constitutes approximately 80% of the deposited waste. The remaining 20% of the deposited waste includes commercial waste and skip waste consisting of typical residential renovation waste, including, but not limited to, timber shards and electric cables.  The extent of the waste body is 0.8 ha, as shown in Figure 2.

### 3. Site investigations

Current condition and appearance of closed landfill:	<p>The surface of the site raises above natural ground level from approximately 3.5m in the eastern part of the site to 7-8m in the western part of the site.</p> <p>The site is used by Galway County Council as a road depot and for storage and heating of road bitumen. There are also two mobile welfare site offices located on the site. There is a 10,000 litre above-ground storage tank (AST) used for the storage of road bitumen, as shown in Figure 2. There is also a heater used for heating bitumen and a liquified petroleum gas (LPG) tank which supplies gas for the heater. Condition 3.18 requires integrity testing of the tanks and associated infrastructure.</p> <p>There is also a partially gravelled and concreted area which was formerly used for fire drills by Galway County Council Fire Brigade, as shown in Figure 2. Within this area there are two 40-foot and two 20-foot truck containers which were used for the fire drills.</p> <p>The stream which flows through the site is culverted through the site. The culvert is covered with waste. Leachate ponding and seepage and iron mottling were observed by the applicant at the mouth of the culvert, at the western site boundary, as stated in the 'Walkover Survey Checklist (carried out originally in 2014 and repeated in September 2019)'.</p>
Site investigations	<p>The site investigations carried out as part of Tier 1, 2 and 3 assessments established the following facts:</p> <ul style="list-style-type: none"> <li>• The landfill is unlined;</li> <li>• The depth of the waste body ranges from 5m to 7m.</li> <li>• The waste body is covered with a layer of soft dark brown gravelly sandy silty peat. The depths of this layer vary across the site;</li> <li>• Groundwater intersects the waste body;</li> <li>• Landfill leachate is being generated; and</li> <li>• Landfill gas is being generated.</li> </ul>
Monitoring and analysis of samples	The following site investigations were carried out as part of Tier 1, 2 and 3 assessments:

(water, gas, waste):	<ul style="list-style-type: none"> <li>• Desk study;</li> <li>• Site walkover surveys were carried out in 2014 and in September 2019;</li> <li>• Topographical survey was carried out on 8<sup>th</sup> April 2014;</li> <li>• Trial pit investigation (twenty two trial pits were excavated between 15<sup>th</sup> and 16<sup>th</sup> January 2014);</li> <li>• Soil sampling (four soil samples were collected from trial pits. The analysis of these samples was carried out in 2014);</li> <li>• Geotechnical soil testing (three soil samples were collected from trial pits. The analysis of these samples was carried out in 2014)</li> <li>• Leachate monitoring (three rounds at two monitoring boreholes were carried out on 24<sup>th</sup> July 2013, 29<sup>th</sup> January 2014 and 5<sup>th</sup> July 2021);</li> <li>• Groundwater monitoring (three rounds at three monitoring boreholes were carried out on 24<sup>th</sup> July 2013, 29<sup>th</sup> January 2014 and 5<sup>th</sup> July 2021);</li> <li>• Surface water monitoring (two rounds, first of which was carried out at three monitoring locations on 29<sup>th</sup> January 2014 and the second round was carried out at seven monitoring locations on 30<sup>th</sup> September 2019);</li> <li>• Invertebrate Kick Sampling was carried out at five locations on 28<sup>th</sup> September 2019; and</li> <li>• Landfill gas monitoring (three rounds at five monitoring locations were carried out on 21<sup>st</sup> April 2014, 30<sup>th</sup> June 2021 and 3<sup>rd</sup> July 2021).</li> </ul>
Hydrology	<p>The closed landfill is located within the catchment of the Erriff-Clew Bay (Catchment Identification Number: 32) and the Bunnahowna_SC_010 sub-catchment (Sub-catchment Id: 32_12).</p> <p>The Cashleen Lough (Lake Id 32_258) is located 630m east of the site. From this lake, an unnamed stream traverses the site (waterbody code: IE_WE_32O030300, segment code: 32_2924) through the valley in a westerly direction. The stream is culverted in a 900mm concrete pipe through the full length of the landfill, i.e. 260m and the culvert pipe is covered with waste. The culvert starts 27m east of the eastern site boundary and finishes approximately 40m downstream on the west of the site. A few meters downstream of the location where the culvert begins on the eastern boundary is a manhole to which water from three culverted storm water drains, which run adjacent to the closed landfill, discharges. The water from the unnamed culverted stream and the three drains flows from the manhole through the site, as shown in Figure 3.1. Along the north-western site boundary flows a small, also unnamed stream (there is no waterbody code or segment code assigned to this stream), as shown in Figure 3.1. This stream discharges into the unnamed stream that traverses the site, at a point approximately 45m downstream of the site.</p> <p>There are a number of storm water ditches within the site and immediately adjacent to the site, as shown in Figure 3.1. The most</p>

distinctive are the ditch which runs along the south-eastern site boundary and discharges into the culverted stream manhole upstream of the landfill and the two ditches which run along the south-western site boundary and discharge, through a settlement pond, into the unnamed stream, that traverses the site, at a location immediately adjacent to the culvert discharge point. The purpose of these ditches is to remove ponded water which results from the storm water run-off from Couravoughil Mountain to the south of the site.

The unnamed stream, that traverses the site, discharges into the Owenglin River (waterbody code: IE\_WE\_32O030300, segment code: 32\_2423) 1km downstream of the site. The Tullyvoheen River (waterbody code: IE\_WE\_32O030300, segment code: 32-699) which flows through the Nambrackkeagh Lough (Lake Id 32\_422) located 360m north-west of the site, discharges into the unnamed stream, that traverses the site, 125m downstream of the site.

The Water Framework Directive (WFD) status assigned to the unnamed stream that traverses the site is classified as Good. Also, the WFD status of the Owenglin River immediately upstream and downstream of the discharge from the unnamed stream is classified as Good.

Surface water monitoring

The applicant carried out surface water monitoring at three locations SW1, SW2 and SW3 on 29<sup>th</sup> January 2014, as shown in Figure 3.1 and at seven locations SW1 to SW7 on 30<sup>th</sup> September 2019, as shown in Figure 3.2. The table below states the location of each monitoring point.

*Table 1: Surface water monitoring locations*

<b>Monitoring location Id</b>	<b>Location</b>
SW1	The unnamed stream that traverses the site, approximately 40m upstream of the site.
SW2	The unnamed stream that traverses the site, approximately 30m downstream of the site.
SW3	The unnamed stream that traverses the site, approximately 137m downstream of the site.
SW4	The unnamed stream that traverses the site, approximately 504m downstream of the site.
SW5	The unnamed stream that traverses the site approximately 0.9km downstream of the site.
SW6	Owenglin River approximately 25m upstream of the discharge from the unnamed stream that traverses the site.
SW7	Owenglin River approximately 1km downstream of the site.

It is noted that monitoring locations SW4, SW5, SW6 and SW7 are

located at significant distances from the landfill. Due to the fact that groundwater beneath the site flows in a westerly direction, as shown in Figures 2 and 5, it is considered that monitoring results from locations SW1, SW2, SW3 and SW4 on the stream are representative of any potential impact from the landfill on surface water quality. Accordingly, the table below shows the maximum parameter concentrations recorded at surface water monitoring locations SW1, SW2, SW3 and SW4 from the monitoring event on 30<sup>th</sup> September 2019.

*Table 2: Surface water monitoring results*

Parameter	EQS <sup>1,2</sup>	Monitoring locations			
		U/s	D/s		
		SW1	SW2	SW3	SW4
Ammonium (as mg NH <sub>4</sub> /l)	≤0.09 (95%ile) Total Ammonia (as mg N/l) <sup>1</sup>	0.041	<b>1.26</b>	<b>0.82</b>	<b>0.42</b>
Molybdate Reactive Phosphorus (MRP) (mg P/l)	≤ 0.045 (95%ile) <sup>1</sup>	<b>0.16</b>	<0.05	<0.05	<0.05
Biochemical Oxygen Demand (BOD) (mg O <sub>2</sub> /l)	≤ 2.2 (high status, 95%) <sup>1</sup>	<1	<1	<1	<1
Cyanide [µg/l]	10 <sup>1</sup>	<b>&lt;50</b>	<b>&lt;50</b>	<b>&lt;50</b>	<b>&lt;50</b>
Cadmium [µg/l]	0.08 <sup>1</sup>	<0.08	<0.08	<0.08	<0.08
Arsenic [µg/l]	25 <sup>1</sup>	1	1	<1	<1
Chromium [µg/l]	3.4 <sup>1</sup>	<b>6.8</b>	<b>5.6</b>	2.4	2.0
Copper [µg/l]	5 <sup>1</sup>	1	<b>6</b>	3	1
Iron [µg/l]	200 <sup>2</sup>	<b>1,700</b>	<b>2,500</b>	<b>1,600</b>	<b>1,200</b>
Manganese [µg/l]	50 <sup>2</sup>	<b>160</b>	<b>200</b>	<b>120</b>	<b>60</b>
Lead [µg/l]	1.2 <sup>1</sup>	<1	<b>2</b>	1	<1
Mercury [µg/l]	0.07 <sup>1</sup>	<b>&lt;0.5</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>	<b>&lt;0.5</b>
Nickel [µg/l]	4 <sup>1</sup>	<1	2	<1	<1
Zinc [µg/l]	50 <sup>1</sup>	21	<b>84</b>	16	20
Benzo(a)pyrene [µg/l]	0.00017 <sup>1</sup>	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(b)fluoranthene [µg/l]	0.017 <sup>1</sup>	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(k)fluoranthene [µg/l]	0.017 <sup>1</sup>	<0.0005	<0.0005	<0.0005	<0.0005
Benzo(g,h,i)-	0.0082 <sup>1</sup>	<0.0005	<0.0005	<0.0005	<0.0005

<sup>1</sup> Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

<sup>2</sup> European Union (Drinking Water) Regulations 2014, S.I. 122 of 2014, as amended.

perylene [ $\mu\text{g/l}$ ]					
Total coliforms [CFU/100ml]	0 <sup>2</sup>	<b>80</b>	<b>90</b>	<b>70</b>	<b>1,230</b>
Faecal coliforms [CFU/100ml]	0 <sup>2</sup>	<b>20</b>	<b>20</b>	<b>10</b>	<b>670</b>

The monitoring results show that concentrations for total ammonia, copper, chromium, lead and zinc exceeded their environmental quality standards (EQSs) set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended, downstream of the landfill. The monitoring results also show that downstream concentrations of iron, manganese, faecal coliforms and total coliforms exceeded their limits set out in European Union (Drinking Water) Regulations 2014, as amended. The fact that the concentrations of a number of parameters at the downstream monitoring locations exceed the concentrations at the upstream location (ammonia, copper, iron, manganese, lead, nickel, zinc, total coliforms and faecal coliforms), indicates that the landfill leachate is having an impact on the downstream surface water quality. It is noted that other sources apart from the landfill may also be impacting results as MRP, chromium, iron, manganese and coliforms also exceed their relevant EQSs/limits at the upstream monitoring location SW1. It is further noted that it cannot be determined whether the actual concentrations for cyanide and mercury, were within the relevant standards as the limit of detection for the monitoring methods utilised were above the EQS.

Condition 3.9(d) and Schedule A.3 require quarterly monitoring of the unnamed stream that traverses the site at the upstream monitoring location SW1 and the downstream monitoring locations SW2, SW3 and SW4. In addition, Condition 3.9(g) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant standard reference values.

#### Invertebrate Kick Sampling

Invertebrate kick sampling was carried out at five locations KS1 to KS5 on the 28<sup>th</sup> September 2019, as shown in Figure 3.2. The below table lists the monitoring locations and Q value assigned to each location sampling result.

*Table 3: Invertebrate kick sampling results*

<b>Monitoring location Id</b>	<b>Location</b>	<b>Q value assigned</b>
KS1	The unnamed stream that traverses the site, approximately 35m downstream of the site.	Q3 (Ecological Status: Poor – moderately polluted)
KS2	The unnamed stream that traverses the site, approximately 140m	Q3 (Ecological Status: Poor – moderately polluted)

		downstream of the site.	
	KS3	The unnamed stream that traverses the site, approximately 500m downstream of the site.	Q4 (Ecological Status: Good – unpolluted)
	KS4	The Owenglin River immediately upstream of the discharge from the stream that traverses the site.	Not assigned due to a very low number of invertebrates.
	KS5	Owenglin River downstream of the discharge form the stream, approximately 1km downstream of the site.	Not assigned due to a very low number of invertebrates.
	<p>The Tier 3 Assessment states that 'while KS1 and KS2 has been assigned Q3, it is plausible that this is an underestimate of the Q-value given the relatively high % EPT (i.e. <i>Ephemeroptera</i>, <i>Plecoptera</i>, <i>Trichoptera</i>) scores observed at these locations and recommends that KS1 and KS2 are re-monitored for Q-values in late spring or early summer'. Additionally, the Tier 3 Assessment states that the macroinvertebrate assemblages recorded for KS4 and KS5 are unusual and that a greater invertebrate abundance at these locations would be expected given the time of year of sampling. The Tier 3 Assessment further recommends a kick sample at KS4 and KS5 in summer, preceding any flood events. Condition 3.11 requires invertebrate kick sampling to be carried out at the existing locations KS1, KS2, KS3, KS4 and KS5 and an additional location upstream of the landfill, following the completion of the remediation measures, as specified in Section '<i>Proposed remediation actions</i>' below.</p>		
Hydrogeology	<p>The closed landfill lies within the Clifden Castlebar groundwater body (GWB Number: IE_WE_G_0017). The status of this groundwater body is good. The site is underlain by a bedrock aquifer which is classified as a Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones (PI). The aquifer vulnerability beneath the site is classified as High and Extreme. Groundwater beneath the site flows in a westerly direction, as shown in Figures 2 and 5.</p> <p>The closed landfill is located 0.5km east from the Clifden Public Water Supply (PWS Id 1200PUB1012_1) which abstracts water from the Nambrackkeagh Lough and serves the Clifden population.</p> <p>There is a private water borehole (borehole Id. 0523NEW001) located 1.75km south-west of the site. This borehole is used for agriculture and domestic purposes. Furthermore, the Tier 2 Assessment states that a review of Galway County Council files indicates the presence of a well to the north of a residence located approximately 400m south-west of the site. Although it is considered doubtful that the water from this well is used as potable water as the files indicate that the residence is served by public water mains, the well may serve as the water supply for livestock. There is also one private water borehole (borehole Id 0525SEW001) located 1.7km north-west of the site. The use of this well</p>		



	<p>is unknown.</p> <p>Due to the fact that groundwater beneath the site flows in a westerly direction, there may be a potential impact on the two boreholes and the well. However, the appropriate capping will limit ingress of rainwater into the waste body thus limiting the generation of leachate which may impact groundwater.</p> <p>Additionally, Condition 3.9(e) and Schedule A.4 require monitoring of groundwater upgradient and downgradient of the waste body on a quarterly basis. Furthermore, Condition 3.4 requires appropriate monitoring on a biannual basis to identify any impact on the quality of water abstracted at wells downgradient of the landfill. Condition 3.4 further requires an assessment of the monitoring results against drinking water standards.</p>
<p>Leachate and water quality:</p>	<p><u>Trial pit investigation</u></p> <p>Twenty two trial pits (TP1 to TP22) were excavated between 15<sup>th</sup> and 16<sup>th</sup> January 2014, as shown in Figure 4, to a depth of between 1.25m and 4.9m below the ground level. Waste was found in twenty trial pits. Made ground consisting of gravelly clayey boulders was found in TP4 and TP8. Bottom of waste was not reached in eleven trial pits; TP2, TP5, TP6, TP7, TP9, TP10, TP13, TP14, TP15, TP16 and TP18. Weathered bedrock was reached in eight trial pits; TP4, TP8, TP11, TP12, TP17, TP19, TP20 and TP22.</p> <p>The waste encountered in trial pits included domestic waste (80%), commercial waste (10%) and C&amp;D waste (10%). The encountered waste included plastic bin bag waste and skip waste consisting of residential renovation waste, including electric cables, timber shards, etc. Also, glass bottles, plastic, ash, cinders, tyres, steel cables, blankets, empty oil bottles (no oil type was specified) and burnt car wheels were encountered.</p> <p>Black staining from suspected sulphides was observed in trial pits TP1 and TP2. Also, sulphide/oil was present in trial pit TP13. Low to moderate 'domestic waste-type odours' were observed at twenty trial pits. A sulphide odour was observed in trial pit TP07 and an oil/sulphide odour in trial pit TP12.</p> <p><u>Soil sampling</u></p> <p>Four undisturbed soil samples were collected from four trial pits within the waste body TP3, TP12, TP17 and TP19 on 29<sup>th</sup> January 2014, as shown in Figure 4. Each of these soil samples was taken from peat or gravel indigenous horizons underlying domestic waste. The analysed parameters included total petroleum hydrocarbons (TPHs), polycyclic aromatic hydrocarbons (PAHs), total phenols, polychlorinated biphenyls (PCBs), heavy metals (arsenic, barium, cadmium, chromium, copper, lead, nickel, molybdenum, mercury, selenium and zinc), total organic carbon and pH.</p> <p>It is noted that the only parameters analysed against the Waste Acceptance Criteria (WAC) in <i>Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC</i></p>

were total organic carbon, PCBs, total aliphatics (mineral oil) and pH, as shown in the table below.

*Table 4: Soil analysis results*

Parameter	Additional limit values <sup>1</sup>			Concentration at trial pits
	Inert	Non-haz	Haz	
Total Organic Carbon [%]	3	5	6	<b>16</b> (TP12)
PCBs (polychlorinated biphenyls, 7 congeners) [mg/kg]	1	-	-	<0.05 (TP12 & TP19) No sample taken for PCBs from TP3 or TP17.
Mineral oil (C10 to C40) [mg/kg]	500	-	-	Total Aliphatics <5 [mg/kg] (TP3, TP12, TP17 & TP19)
pH	-	Minimum 6	-	7.6 (TP12) 7.7 (TP19) Not measured in samples from TP3 or TP17.

The analysis results show that the concentration of total organic carbon meets the hazardous landfill waste acceptance criteria.

PAHs were compared against the limit for Total PAHs of 100mg/kg set in a waste licence for an inert landfill (Licence Reg. No. Reg. W0129-02). Parameters were also analysed against the Dutch Criteria<sup>2</sup>, LQM/CIEH Generic Assessment Criteria<sup>3</sup> and CLEA Soil Guideline Values<sup>4</sup>. Mercury in a sample from TP17 was recorded at 0.78mg/kg which exceeded the Dutch Target Value for this parameter of 0.3mg/kg. Additionally, total organic carbon was measured at 16% in a sample from TP12, exceeding the Waste Acceptance Criteria for Inert Waste in the Licence Reg. No. W0129-02. The Tier 2 Assessment states that the soil in the sample from TP12 was classified as a silty sandy gravelly peat and therefore, it would be expected to have a high percentage of total organic carbon. The Tier 2 Assessment also states that given that significant levels of contaminants were not found within the soil samples it was decided not to submit samples for leachate

<sup>1</sup> Limit values in addition to the soil leaching limit values, as per Waste Acceptance Criteria (WAC) as set out in Council Decision of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of and Annex II to Directive 1999/31/EC.

<sup>2</sup> National Institute of Public Health and the Environment of The Netherlands - The Soil Protection Guidelines (Dutch Criteria).

<sup>3</sup> LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment, 2<sup>nd</sup> Edition, 2011.

<sup>4</sup> UK Department of Environment, Food and Rural Affairs (DEFRA) - Contaminated Land Exposure Assessment (CLEA) Model – Soil Guideline Values, 2009.

preparation and subsequent analysis. Accordingly, no leachate testing was carried out in accordance with the said WAC in the said Council Directive. Monitoring of mercury in leachate, surface water and groundwater however has been included in the relevant monitoring schedules of the draft certificate of authorisation.

Geotechnical soil testing

Three soil samples of the existing landfill cover material were collected from trial pits TP6, TP11 and TP19. Each soil sample was analysed for particle size distribution (PSD), Plasticity Index of between 10% and 65% and Liquid Limit of less than 90% required for compacted clay liners to serve as a landfill cap. All three soil samples were described as '*Dark brown gravelly sandy silty peat with fibrous roots*' and conformed to the Plasticity Index and Liquid Limit requirements. However, each of the soil samples was found to be under the recommended minimum Fines Content for clay and silt of more than 30%.

Landfill leachate monitoring

Leachate monitoring was carried out at two monitoring boreholes LC1 and LC2 within the waste body on 24<sup>th</sup> July 2013 and 29<sup>th</sup> January 2014. Additionally, borehole LC1 was monitored on 5<sup>th</sup> July 2021, as shown in Figure 2. Borehole LC2 could not be accessed at the time of sampling in July 2021. The table below shows the profile of the leachate monitoring boreholes installed at the site.

*Table 5: Leachate monitoring boreholes*

<b>Borehole Id</b>	<b>Borehole depth (m bgl)</b>	<b>Perched water table (m bgl)</b>	<b>Bedrock</b>	<b>Depth of waste (m bgl)</b>
LC1 (also referred to in the Tier 2 Assessment as LW01)	6.1	3.2	Weathered Bedrock encountered at 6.1m bgl.	Between 0.8m and 5m bgl.
LC2 (also referred to in the Tier 2 Assessment as LW02)	9.0	4.2	Weathered bedrock encountered at 9.0m bgl.	Between 0.2m and 8m bgl.

The table below shows the parameter concentrations recorded at the monitoring borehole LC1 on 5<sup>th</sup> July 2021 and the monitoring borehole LC2 on 29<sup>th</sup> January 2014.

*Table 6: Leachate monitoring results*

Parameter	EQS/ Limit 1,2,3,4	LC1 (monitoring in 2021)	LC2 (monitoring in 2014)
Electrical conductivity [µS/cm]	1,875 <sup>1</sup>	740	1,500
Ammonium as NH <sub>4</sub> [mg/l]	0.065 <sup>1</sup> Ammonium as N	<b>20.1</b>	<b>60</b>
COD [mg/l]	20 <sup>2</sup>	<b>3,580</b>	<b>100</b>
BOD [mg/l]	2.2 <sup>3</sup>	<b>102</b>	Not measured
Total dissolved solids [mg/l]	1,000 <sup>2</sup>	480	890
Potassium [mg/l]	5 <sup>2</sup>	<b>6</b>	<b>20</b>
Sodium [mg/l]	150 <sup>1</sup>	19	20
Calcium [mg/l]	200 <sup>2</sup>	100	140
Magnesium [mg/l]	50 <sup>2</sup>	11	20
Arsenic [µg/l]	7.5 <sup>1</sup>	<0.2	1.5
Boron [µg/l]	750 <sup>1</sup>	130	<b>810</b>
Cadmium [µg/l]	3.75 <sup>1</sup>	<0.11	<0.080
Chromium [µg/l]	37.5 <sup>1</sup>	<0.50	2.0
Copper [µg/l]	1,500 <sup>1</sup>	<0.50	<1.0
Iron [µg/l]	200 <sup>2</sup>	19	<b>2,900</b>
Lead [µg/l]	7.5 <sup>1</sup>	<0.50	<1.0
Nickel [µg/l]	15 <sup>1</sup>	<0.50	<b>16</b>
Manganese [µg/l]	50 <sup>2</sup>	<b>600</b>	<b>1,300</b>
Mercury [µg/l]	0.75 <sup>1</sup>	0.07	<0.5
Zinc [µg/l]	75 <sup>1</sup>	<2.5	9.3
Benzene [µg/l]	0.75 <sup>1</sup>	<0.001	1.4
Benzo(bk)fluoranthene [µg/l]	Total PAHs	<0.0005	<b>&lt;0.5</b>

<sup>1</sup> European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

<sup>2</sup> As set out in the EPA publication 'Towards setting guideline values for the protection of groundwater in Ireland – Interim Report', 2003.

<sup>3</sup> Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

<sup>4</sup> European Union (Drinking Water) Regulations 2014, S.I. No. 122 of 2014.

Indeno(123cd)pyrene [µg/l]	0.075 <sup>1</sup>	<0.0005	<b>&lt;0.5</b>
Benzo(ghi)perylene [µg/l]		<0.0005	<b>&lt;0.5</b>
Anthracene [µg/l]		<0.0005	<b>&lt;0.5</b>
Naphthalene [µg/l]		<0.0005	<b>0.99</b>
Faecal coliforms [CFU/100ml]	0 <sup>4</sup>	<b>&lt;10,000</b>	Not measured
Total coliforms [CFU/100ml]	0 <sup>4</sup>	<b>&lt;10,000</b>	Not measured
Enterococci [CFU/100ml]	0 <sup>4</sup>	<b>&lt;10,000</b>	Not measured
<i>Clostridium perfringens</i> [CFU/100ml]	0 <sup>4</sup>	<b>55,000</b>	Not measured

The monitoring results show that a number of parameters in the landfill leachate exceeded the relevant standards/limits, indicating that leachate poses a risk to surface water bodies and groundwater. It is also noted that molybdate reactive phosphorus or cyanide were not monitored at any of the locations and BOD was not measured at location LC2. Furthermore, it cannot be determined whether the total PAHs were within the relevant standards at location LC2 as the limits of detection for the monitoring methods were above the EQSs.

Condition 3.9(b) and Schedule A.1 require leachate monitoring in the existing leachate monitoring boreholes LC1 and LC2 on a quarterly basis. Schedule A.1 specifies the minimum parameters to be monitored. Additionally, Condition 3.9(g) requires that the sensitivity of the monitoring methods utilised shall have an appropriate limit of detection to allow for comparison of pollutant concentrations against the relevant standard reference values and/or parametric values.

#### Groundwater quality

Groundwater monitoring was carried out at three groundwater monitoring boreholes BH1, BH2 and BH3 on 24<sup>th</sup> July 2013, 29<sup>th</sup> January 2014 and 5<sup>th</sup> July 2021, as shown in Figure 2 and listed in the table below. It is noted that each monitoring location is located within the waste body near the waste body edge. The table below outlines the profile of the monitoring boreholes.

*Table 7: Groundwater monitoring boreholes*

Borehole Id	Borehole Depth (m bgl)	Perched water table (m bgl)	Depth at which bedrock was encountered (m bgl)	Depth of waste (m bgl)
BH1	12	4.2	6.4	Between 0.5m and 5.2m bgl.

BH2	17.5	3.9	3.0	Between 0.8m and 2m bgl.
BH3	10.0	2.2	8.6 (weathered bedrock)	Between 0.8m and 2.2m bgl

The table below shows the 2021 groundwater monitoring results at the upgradient monitoring borehole BH1 and downgradient monitoring borehole BH2.

*Table 8: Groundwater monitoring results*

Parameter	EQS/ Limit <sup>1,2,3,4</sup>	BH1 Upgradient monitoring location within the waste body	BH2 Downgradient monitoring location within the waste body
Electrical conductivity [µS/cm]	1,875 <sup>1</sup>	740	<b>2,000</b>
Ammonium as NH <sub>4</sub> [mg/l]	0.065 <sup>1</sup> Ammonium as N	<b>18.4</b>	<b>2.0</b>
COD [mg/l]	20 <sup>2</sup>	<b>60</b>	<b>239</b>
BOD [mg/l]	2.2 <sup>3</sup>	<b>8</b>	<b>3</b>
Total dissolved solids [mg/l]	1,000 <sup>2</sup>	480	<b>1,300</b>
Potassium [mg/l]	5 <sup>2</sup>	<b>10</b>	3.1
Sodium [mg/l]	150 <sup>1</sup>	85	<b>320</b>
Calcium [mg/l]	200 <sup>2</sup>	100	110
Magnesium [mg/l]	50 <sup>2</sup>	20	8
Arsenic [µg/l]	7.5 <sup>1</sup>	0.75	1.9
Boron [µg/l]	750 <sup>1</sup>	220	72
Cadmium [µg/l]	3.75 <sup>1</sup>	<0.11	<0.11
Chromium [µg/l]	37.5 <sup>1</sup>	<0.50	<0.50
Copper [µg/l]	1,500 <sup>1</sup>	<0.50	<0.50
Iron [µg/l]	200 <sup>2</sup>	<b>490</b>	<b>980</b>

<sup>1</sup> European Communities Environmental Objectives (Groundwater) Regulations, 2010, as amended.

<sup>2</sup> As set out in the EPA publication 'Towards setting guideline values for the protection of groundwater in Ireland – Interim Report', 2003.

<sup>3</sup> Environmental Quality Standard (EQS) as set out in European Communities Environmental Objectives (Surface Water) Regulations 2009, as amended.

<sup>4</sup> European Union (Drinking Water) Regulations 2014, S.I. No. 122 of 2014.

Lead [ $\mu\text{g/l}$ ]	7.5 <sup>1</sup>	<0.50	<0.50
Nickel [ $\mu\text{g/l}$ ]	15 <sup>1</sup>	3.9	7.1
Manganese [ $\mu\text{g/l}$ ]	50 <sup>2</sup>	<b>810</b>	<b>920</b>
Mercury [ $\mu\text{g/l}$ ]	0.75 <sup>1</sup>	0.06	0.06
Zinc [ $\mu\text{g/l}$ ]	75 <sup>1</sup>	7.3	<2.5
Benzene [ $\mu\text{g/l}$ ]	0.75 <sup>1</sup>	<0.001	<0.001
Benzo(bk)fluoranthene [ $\mu\text{g/l}$ ]	Total PAHs 0.075 <sup>1</sup>	<0.0005	<0.0005
Indeno(123cd)pyrene [ $\mu\text{g/l}$ ]		<0.0005	<0.0005
Benzo(ghi)perylene [ $\mu\text{g/l}$ ]		<0.0005	<0.0005
Anthracene [ $\mu\text{g/l}$ ]		<0.0005	<0.0005
Naphthalene [ $\mu\text{g/l}$ ]		<0.0005	<0.0005
Faecal coliforms [CFU/100ml]	0 <sup>4</sup>	0	<b>&lt;10,000</b>
Total coliforms [CFU/100ml]	0 <sup>4</sup>	0	<b>&lt;10,000</b>
<i>Enterococci</i> [CFU/100ml]	0 <sup>4</sup>	0	<b>&lt;10,000</b>
<i>Clostridium perfringens</i> [CFU/100ml]	0 <sup>4</sup>	<b>100</b>	<b>&lt;10,000</b>

The monitoring results show that the landfill is impacting groundwater quality. However, it is also noted that the exceedances of ammonium, potassium, faecal coliforms, total coliforms and other parameters at the upgradient monitoring location may indicate that groundwater quality is also impacted by factors other than the landfill. It is also noted that molybdate reactive phosphorus or cyanide were not monitored at any of the locations.

It is noted that, along the western and south-western site boundary, the site extends beyond the waste body, as shown in Figure 2. This area of the site is considered appropriate for installation of monitoring boreholes for monitoring of groundwater downgradient of the waste body. Accordingly, Condition 3.1(e) requires installation of at least two groundwater monitoring boreholes downgradient of the waste body. Condition 3.9(e) and Schedule A.4 require groundwater monitoring at the existing borehole BH1 and at the two additional boreholes required under Condition 3.1(e) on a quarterly basis. Schedule A.4 specifies the minimum parameters to be monitored. Also, due to the fact that the waste contains municipal waste, it is considered that monitoring for organic compounds in the groundwater is appropriate. Accordingly, Condition 3.9(f) requires an annual screening of groundwater for trace organic substances.

Landfill gas:

Landfill gas can migrate from the waste body. The most likely pathway for the migration of landfill gas is through the underlying soils and the existing cover layer over the waste. It is noted however that the applicant assigned a score of zero to the lateral migration of gas (SPR 10) due the nearest residence being located approximately 400m from the site. It is noted however that a scenario where a human receptor is located at a distance greater than 250m from the waste body is assigned scoring points, as per Table 3f of the EPA Code of Practice<sup>1</sup>, and should therefore be included in the calculation of the SPR 10 score. Accordingly, the score for the lateral gas migration (SPR 10) was recalculated by the Agency as part of the application assessment, resulting in the classification of the risk from lateral gas migration as Low risk.

Additionally, a score of zero was assigned to the vertical migration of gas (SPR 11) due to the absence of houses directly over the waste body. The applicant also states that the two mobile welfare offices located on the site are sealed and well ventilated. Accordingly, the vertical migration of landfill gas was not identified by the applicant as a risk from the site. It is considered however that the on-site mobile offices constitute as human receptors therefore, the assignment of the zero score to the risk from the vertical gas migration (SPR 11) is considered incorrect. Accordingly, the score for SPR 11 was recalculated by the Agency as part of the application assessment, resulting in the classification of the risk from vertical gas migration as Low risk.

Gas monitoring was carried out at monitoring locations LC1 and LC2 and BH1, BH2 and BH3 on 21<sup>st</sup> April 2014, 30<sup>th</sup> June 2021 and 3<sup>rd</sup> July 2021, as shown in Figure 2.

The 2014 monitoring involved fitting a 2-inch rubber bung with a gas tap to each borehole and allowing the landfill gas to equilibrate for 82 days prior to gas measuring on 21<sup>st</sup> April 2014, using a GA2000 Landfill Gas analyser. Landfill gas monitoring in 2021 was carried out using a GA5000 Landfill Gas analyser. The 2014 and 2021 monitored parameters included methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), carbon monoxide (CO), hydrogen sulphide (H<sub>2</sub>S) and oxygen (O<sub>2</sub>). No gas flow was monitored.

The following table shows the maximum concentrations of methane and carbon dioxide measured at the five monitoring locations in April 2014, June 2021 and July 2021.

*Table 9: Landfill gas monitoring results*

Borehole Id	Monitoring in April 2014		Monitoring in June 2021		Monitoring in July 2021	
	Methane (% v/v)	Carbon dioxide (% v/v)	Methane (% v/v)	Carbon dioxide (% v/v)	Methane (% v/v)	Carbon dioxide (% v/v)
LC1	1.1	0.5	<b>53.7</b>	<b>12.4</b>	<b>36.7</b>	<b>12.9</b>

<sup>1</sup> Sections 4.3.3 and 4.4.1 of The EPA Code of Practice, Environmental Risk Assessment for Unregulated Waste Disposal Sites, 2007.



LC2	0.8	0.7	<b>34.1</b>	<b>14.1</b>	<b>34.9</b>	<b>15.1</b>
BH1	0.2	0.1	<b>1.6</b>	<b>8.8</b>	0.8	<b>9.1</b>
BH2	0.1	0.1	0.2	0	0.7	0.2
BH3	0.2	0.2	<b>3.7</b>	<b>3.8</b>	0.5	<b>6.1</b>

The monitoring results show that landfill gas is being generated within the waste body and may be migrating outside the waste body, as indicated by the presence of gas in the monitoring locations at the edge of the waste body BH1, BH2 and BH3. It is also noted that the trigger levels for monitoring emissions of methane and carbon dioxide outside the waste body of, respectively, 1% v/v or greater and 1.5% v/v or greater, as set out in the Agency Landfill Manuals - Landfill Monitoring, 2<sup>nd</sup> Edition, 2003, were exceeded in respect of methane in June 2021 at two locations at the edge of the waste body (1.6% at BH1 and 3.7% at BH3) and, at the same locations in respect of carbon dioxide, in June 2021 (8.8% at BH1 and 3.8% at BH3) and July 2021 (9.1% at BH1 and 6.1% at BH3). It is furthermore noted that the gas levels monitored at locations LC1, LC2, BH2 and BH3 in 2014 were significantly lower than the gas levels measured at these locations in 2021.

In the correspondence dated 16<sup>th</sup> September 2021, the applicant stated that a number of factors may explain the high levels of methane encountered in 2021 and that it is likely that the natural peat underlying the waste is contributing to the levels observed. The applicant further stated that it is also possible that the methane generated in July 2021 was at peak levels due to the seasonal lowering of the groundwater table and the increase in ground temperature. Considering the potential presence of varying levels of methane gas on site, it is considered advisable that a health and safety risk assessment is carried out to assess the use of the site for heating bitumen.

Condition 3.9(c) and Schedule A.2 require gas monitoring to detect the presence and concentration of landfill gas on a quarterly basis. Condition 3.12 enables changes to monitoring requirements, with the agreement of the Agency following evaluation of test results and/or relevant proposals. Furthermore, the measured landfill gas levels, as described above, indicate that there may be pockets of landfill gas within the waste body. Therefore, it is considered that gas vents are required within the waste body for appropriate gas management. Condition 3.1(c) requires the installation of gas vents in accordance with the EPA Landfill Manuals – Landfill Site Design and that spacing between the gas vent pipes shall be sufficient to achieve adequate gas venting.

Conceptual site model:

Tier 1 Assessment determined that the overall risk score for the closed landfill was High (Class A). This classification was due to the risk of landfill leachate migration to surface waters.

Following Tier 2 and Tier 3 investigations this risk classification remains High (Class A), due to the risk of leachate migration into the stream that flows through the site.

The conceptual site model is shown in Figure 5.

#### 4. SPR linkages and remedial actions

<p>SPR linkage scenarios (applicable ones only):</p>	<p><b>Leachate and gas migration scores:</b></p> <p>As discussed in the section titled 'Landfill gas' above, SPR linkages for lateral and vertical gas migration (SPR 10 and SPR 11) have been recalculated by the Agency and assigned as Low risk below.</p> <p><u>High scores:</u></p> <p>One pathway was identified as High Risk:</p> <ul style="list-style-type: none"> <li>• Migration of leachate, via surface water drainage/runoff, to surface water bodies (SPR 8).</li> </ul> <p><u>Moderate scores:</u></p> <p>One pathway was identified as Moderate Risk:</p> <ul style="list-style-type: none"> <li>• Migration of leachate, via groundwater flowing to water drainage/runoff, to surface waterbodies (SPR 1).</li> </ul> <p><u>Low scores:</u></p> <p>Eight pathways were identified as Low Risk:</p> <ul style="list-style-type: none"> <li>• Migration of leachate, via groundwater, to Surface Water Body Protected Areas (SWDTE) (SPR 2);</li> <li>• Migration of leachate to private wells (SPR 3);</li> <li>• Migration of leachate into Groundwater Protected Areas (GWDTE) (SPR4);</li> <li>• Migration of leachate to the underlying aquifer (SPR 5);</li> <li>• Migration of leachate, via groundwater migration, to surface water bodies (SPR 7);</li> <li>• Migration of leachate, via surface water drainage/runoff, to Surface Water Body Protected Areas (SPR 9);</li> <li>• Human health exposure pathway of off-site lateral migration of landfill gas into nearby buildings (SPR 10); and</li> <li>• Vertical landfill gas migration (SPR 11).</li> </ul> <p><b>Summary:</b></p> <p>Upon the review of the monitoring data;</p> <ul style="list-style-type: none"> <li>• remedial action is warranted to address the risk of leachate migrating from the site into surface water and groundwater.</li> <li>• remedial action is warranted to address the risk of migration of landfill gas within the site and off-site.</li> </ul>
<p>Proposed remedial actions:</p>	<p>No remedial measures, other than using the existing cover material as the landfill cap, were proposed by the applicant.</p> <p>In the correspondence dated 26<sup>th</sup> February 2021, the applicant stated that '<i>the construction of an engineered cap by way of</i></p>

*improving the existing cap would not have represented a significant benefit to the groundwater and surface water quality in the area as a significant portion of the contamination within the waste had most likely already leached out of the waste body'.*

However, due to the fact that the landfill is affecting water quality in the unnamed stream that traverses the site, as outlined in Section 'Hydrology' above, and the fact that this stream discharges into The Twelve Bens/Garraun Complex SAC (site code: 002031), 1km downstream of the site, it is considered that an engineered cap, which will limit ingress of rainwater into the waste body, thus limiting the generation of leachate, is appropriate for the landfill. Accordingly, Condition 3.1(b) requires a landfill cap that comprises of a minimum 1m thick mineral layer with a 1mm thick geomembrane, or equivalent, to achieve the hydraulic conductivity of  $1 \times 10^{-9} \text{m/s}$ .

Furthermore, the measured landfill gas levels, as shown in Table 9 above, indicate that landfill gas is being generated within the waste body. Therefore, and additionally considering that the site is used by the applicant for storage/as a road depot and has two mobile welfare site offices, it is considered that gas vents are required within the waste body to provide for controlled gas ventilation. Condition 3.1(c) requires the installation of gas vents in accordance with the EPA Landfill Manuals – Landfill Site Design and that spacing between the gas vent pipes shall be sufficient to achieve adequate gas venting. Additionally, Condition 3.1(g) requires installation of gas alarms in the two mobile welfare site offices.

Additionally, Condition 3.8 requires a drawing showing the interpolated extent of the waste body, the area capped in accordance with Condition 3.1(b) and the gas vents installed in accordance with Condition 3.1(c).

#### Environmental monitoring

Tier 3 Assessment recommends the monitoring of the private well at the residence located approximately 400m south-west of the site and Invertebrate Kick Sampling, as follows.

##### *Private well monitoring*

The Tier 3 Assessment states that even though it is unlikely that the well has been impacted by contaminated groundwater emanating from the site, it is recommended, in the event that this well is used for livestock, that water from this well is sampled and analysed for a comprehensive laboratory suite.

Condition 3.4 requires appropriate monitoring to be carried out on a biannual basis to identify any impact on the quality of water abstracted at wells downgradient of the landfill. Condition 3.4 further requires an assessment of the monitoring results against drinking water standards.

*Invertebrate Kick Sampling*

The Tier 3 Assessment recommends a further invertebrate kick sampling is carried out, as outlined in Section 'Hydrology' above.

Condition 3.11 requires invertebrate kick sampling at the existing locations KS1 to KS5 and an additional location upstream of the landfill within six months of the completion of the remediation measures.

Having regard to the monitoring results submitted in support of the application for a certificate of authorisation and the age of the closed landfill, the following remedial measures are considered appropriate and recommended in Condition 3.1:

- (a) Minimise the disturbance of deposited waste to the extent possible;
- (b) Install a low permeability landfill cap over the waste body, excluding hard-standing impermeable areas of the site, minimum 1m with 1mm thick low permeability geomembrane, or equivalent, to achieve a hydraulic conductivity of less than or equal to  $1 \times 10^{-9} \text{m/s}$ ;
- (c) Install and operate a gas management system, within 6 months of the date of grant of this Certificate of Authorisation.

The design of the gas management system (layout, depth, sealing etc.) shall be in accordance with the EPA Landfill Manuals – Landfill Site Design.

The gas management system shall include the following elements:

- (i) Gas vent pipes with fans or cowls, as appropriate.
  - The gas vent pipes shall not be perforated above ground level; and
  - The spacing between the gas vent pipes shall be sufficient to achieve adequate gas venting.
- (d) On agreement by the Agency, the gas management system and associated infrastructure may be removed or altered if required.
- (e) Install at least two groundwater monitoring boreholes downgradient of the waste body;
- (f) Reseed grass within the site; and
- (g) Install gas alarms in the two mobile welfare site offices.

The proposed remedial measures are intended to break the SPR linkages by preventing:

- migration of leachate into the aquifer and surface water

	<p>bodies.</p> <ul style="list-style-type: none"> <li>• migration of landfill gas in an uncontrolled manner.</li> </ul> <p>The recommended certificate of authorisation allows for the importation and use of soil and stone to complete the works.</p>
Proposed aftercare monitoring and assessment:	<p>Monitoring as specified in Condition 3.9 and Schedule A of the recommended certificate of authorisation.</p> <p>Validation report to be submitted within 30 months.</p>
Adequacy of risk assessment:	<p>Regulation 7(7) of the Regulations states that the EPA must be satisfied with the risk assessment before proposing to grant a certificate of authorisation. The risk assessment is adequate as it has identified, assessed and adequately addressed the associated risks inherent within the landfill site.</p>

## 5. Appropriate Assessment

Appendix 1 lists the European Sites assessed, their associated qualifying interests and conservation objectives along with the assessment of the effects of the activity on the European Sites.

A screening for Appropriate Assessment was undertaken to assess, in view of best scientific knowledge and the conservation objectives of the site, if the activity, individually or in combination with other plans or projects is likely to have a significant effect on any European Site. In this context, particular attention was paid to the European Sites at The Twelve Bens/Garraun Complex SAC (site code: 002031), West Connacht Coast SAC (site code: 002998), Slyne Head Peninsula SAC (site code: 002074) and Connemara Bog Complex SAC (site code: 002034).

The activity is not directly connected with or necessary to the management of any European Site and the Agency considered, for the reasons set out below, that it cannot be excluded, on the basis of objective information, that the activity, individually or in combination with other plans or projects, will have a significant effect on any European Site and accordingly determined that an Appropriate Assessment of the activity was required. A Natura Impact Statement was not requested as it was considered that there was sufficient information available to allow Appropriate Assessment to be carried out.

The reasons for this determination are as follows:

- The unnamed stream (waterbody code: IE\_WE\_32O030300) flows through the site and discharges into The Twelve Bens/Garraun Complex SAC (site code: 002031), 1km downstream of the site. Although this stream is culverted within the site, the 'Further Information – Hydrology/Tier 3 GQRA/CSM' Report states that landfill leachate is entering the stream. Hence, there is a hydrological connection between the closed landfill and this European Site.
- There is a hydrological connection, via the said unnamed stream which discharges into the Owenglin River (waterbody code: IE\_WE\_32O030300), which then flows into the transitional waterbody (waterbody code: IE\_WE\_270\_0100) and coastal waters (waterbody codes: IE\_WE\_250\_0000 and IE\_WE\_260\_0000), between the closed landfill and the following European Sites: the West Connacht Coast SAC (002998), Slyne Head Peninsula SAC (002074) and Connemara Bog Complex SAC (002034).

An Inspector's Appropriate Assessment has been completed and has determined, based on best scientific knowledge in the field and in accordance with the European Communities

(Birds and Natural Habitats) Regulations 2011 as amended, pursuant to Article 6(3) of the Habitats Directive, that the activity, individually or in combination with other plans or projects, will not adversely affect the integrity of any European Site, in particular The Twelve Bens/Garraun Complex SAC (site code: 002031), West Connacht Coast SAC (site code: 002998), Slyne Head Peninsula SAC (site code: 002074) and Connemara Bog Complex SAC (site code: 002034), having regard to their conservation objectives and will not affect the preservation of these sites at favourable conservation status if carried out in accordance with the recommended certificate of authorisation and the Conditions attached hereto for the following reasons:

- Specifically, the remedial works will be undertaken to minimise the potential for water pollution in The Twelve Bens/Garraun Complex SAC (site code: 002031), West Connacht Coast SAC (site code: 002998), Slyne Head Peninsula SAC (site code: 002074) and Connemara Bog Complex SAC (site code: 002034) and will ensure that there will be no significant impact on these European Sites; and
- The project alone, which consists of the remediation of the closed landfill, or in combination with other projects, will not adversely affect the integrity and conservation status of any of the qualifying interests of The Twelve Bens/Garraun Complex SAC (site code: 002031), West Connacht Coast SAC (site code: 002998), Slyne Head Peninsula SAC (site code: 002074) and Connemara Bog Complex SAC (site code: 002034).

In light of the foregoing reasons, no reasonable scientific doubt remains as to the absence of adverse effects on the integrity of those European Sites: The Twelve Bens/Garraun Complex SAC (site code: 002031), West Connacht Coast SAC (site code: 002998), Slyne Head Peninsula SAC (site code: 002074) and Connemara Bog Complex SAC (site code: 002034).

## 6. Recommendation

I recommend granting the certificate of authorisation as proposed.

Signed



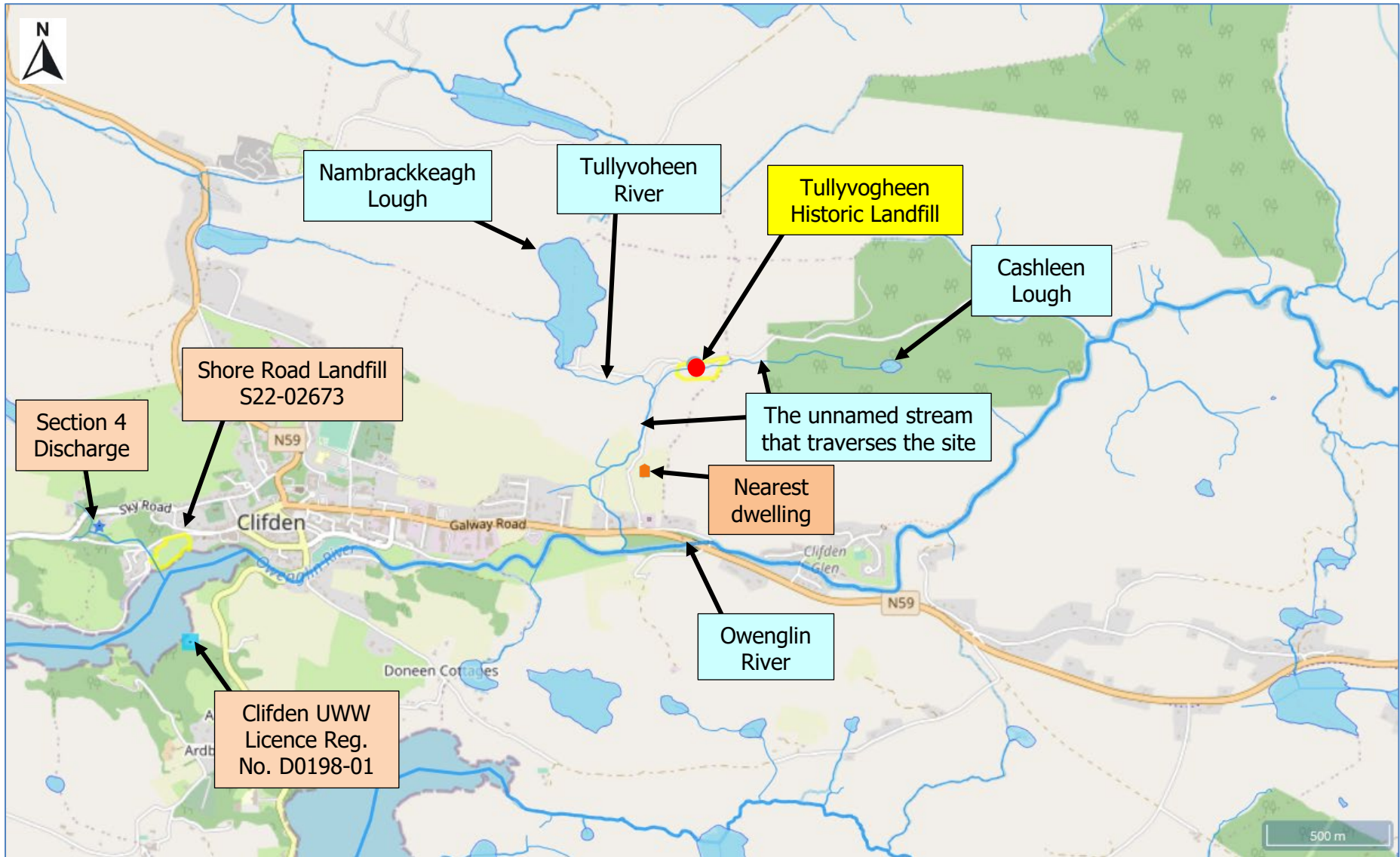
Ewa Babiarczyk

Date 18<sup>th</sup> May 2022

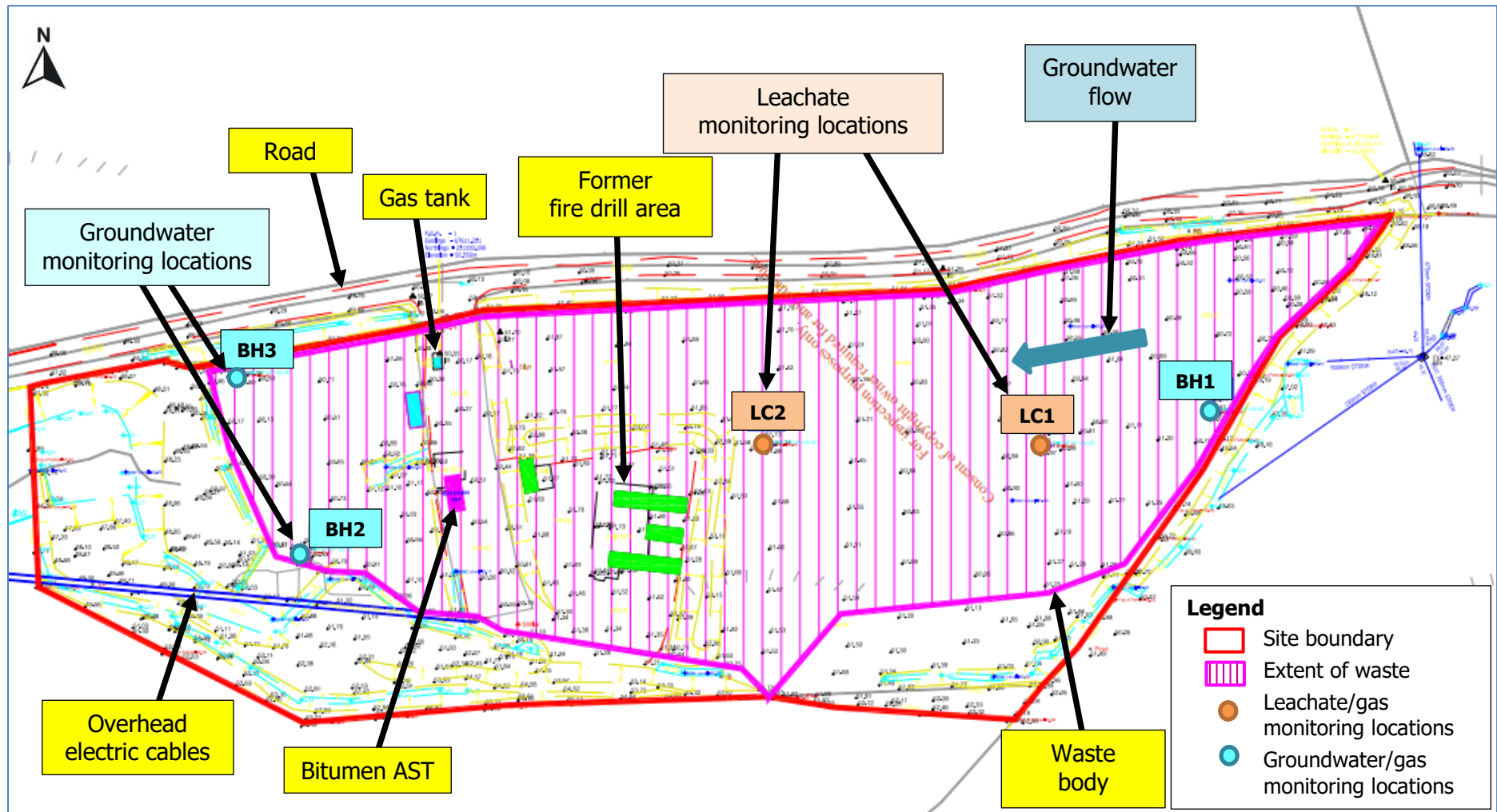
## Procedural Note

Any representations received by the Agency within 30 days of the draft certificate of authorisation being made available will be considered by the Agency.

As soon as practicable after the expiry of the 30-day period the Agency will determine the certificate of authorisation, which may vary from the draft certificate, and shall issue an appropriately validated certificate of authorisation in accordance with the Waste Management (Certificate of Historic Unlicensed Waste Disposal and Recovery Activity) Regulations 2008.

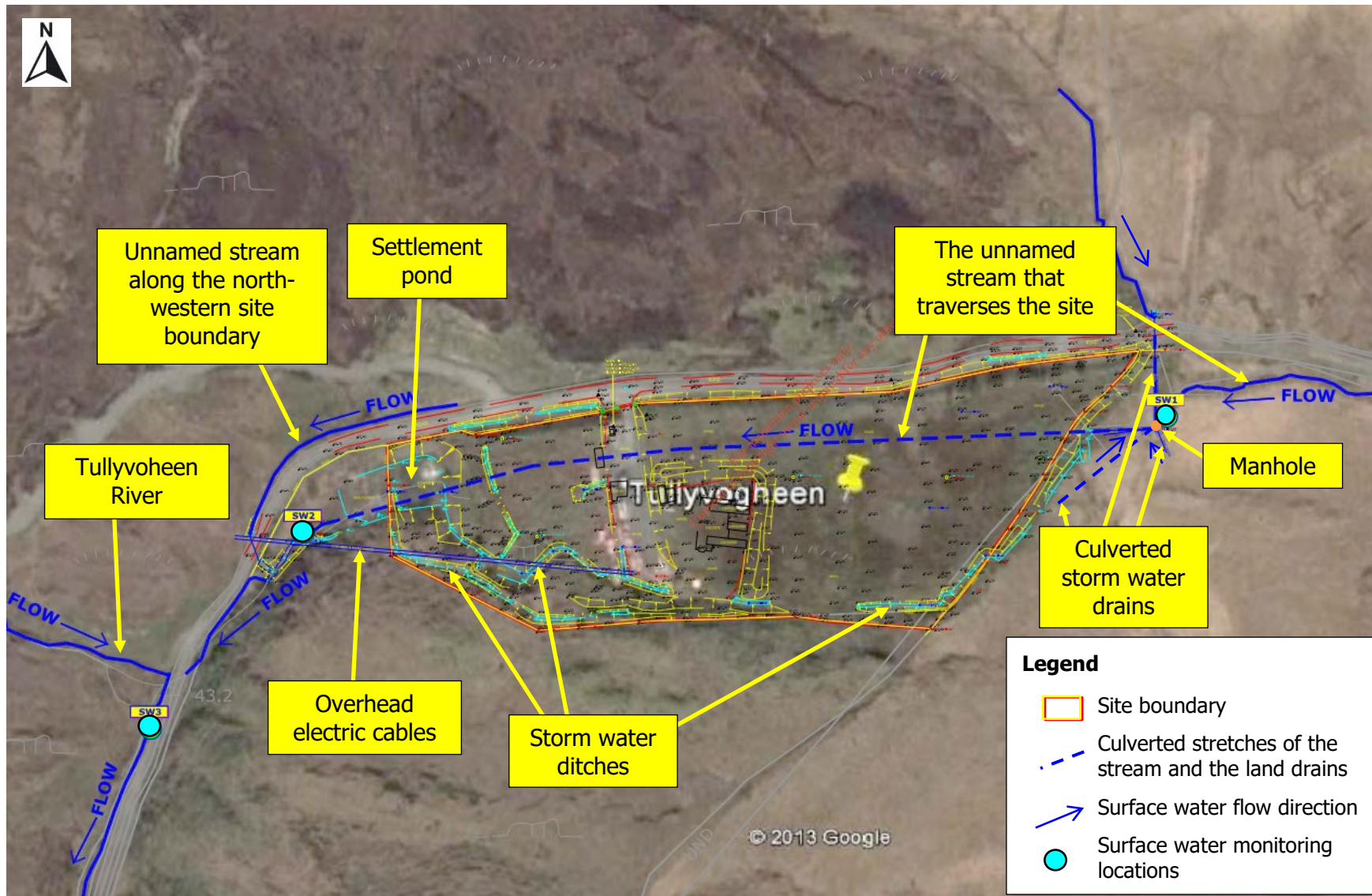


**Figure 1: Location of Tullyvogheen Historic Landfill**

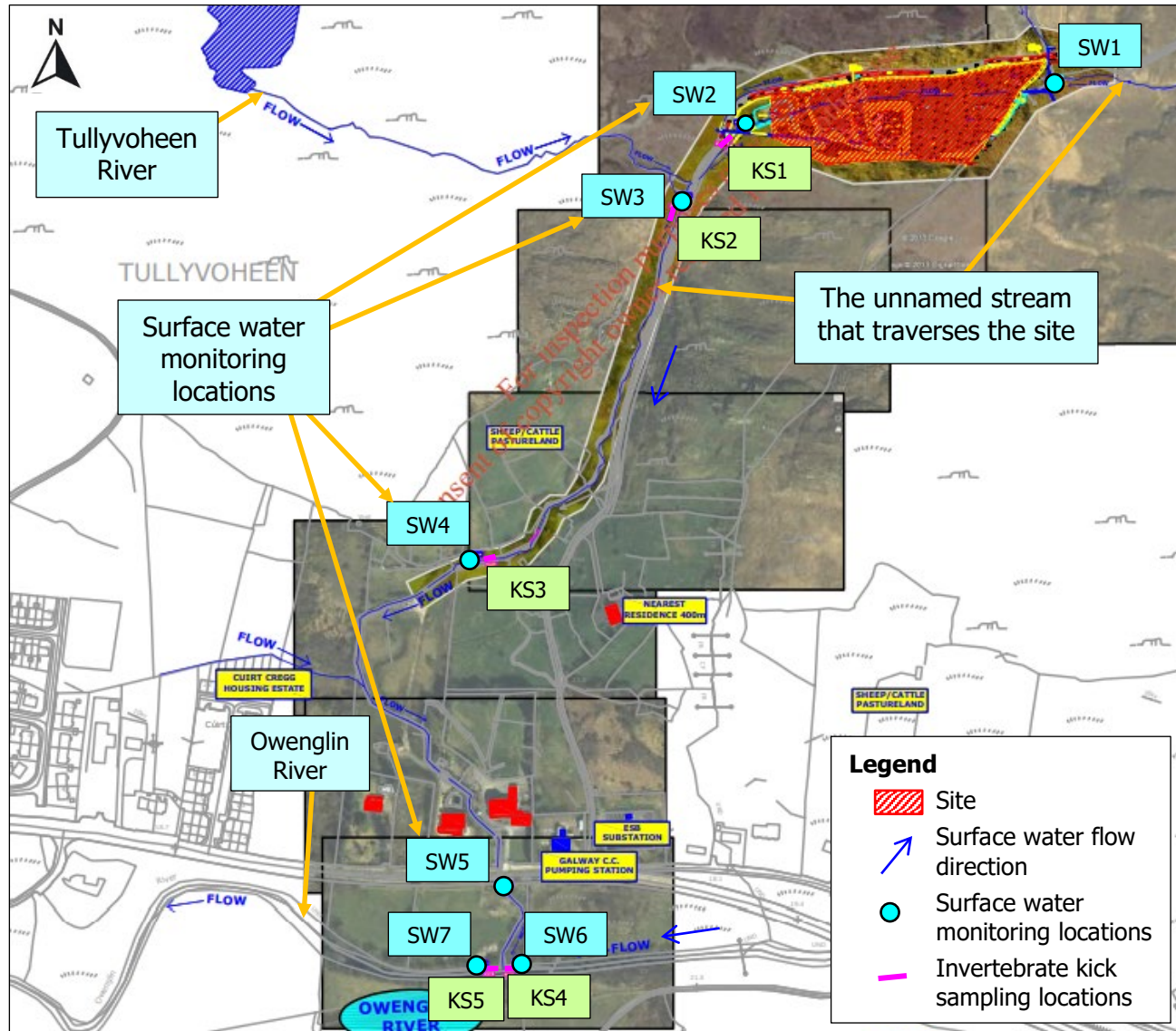


**Figure 2: Site layout, extent of the deposited waste and groundwater (BH), leachate (LC), gas (BH & LC) monitoring locations**





**Figure 3.1: Surface water monitoring locations SW1 to SW3**



**Figure 3.2: Surface water monitoring locations SW1 to SW7 and Invertebrate kick sampling locations**

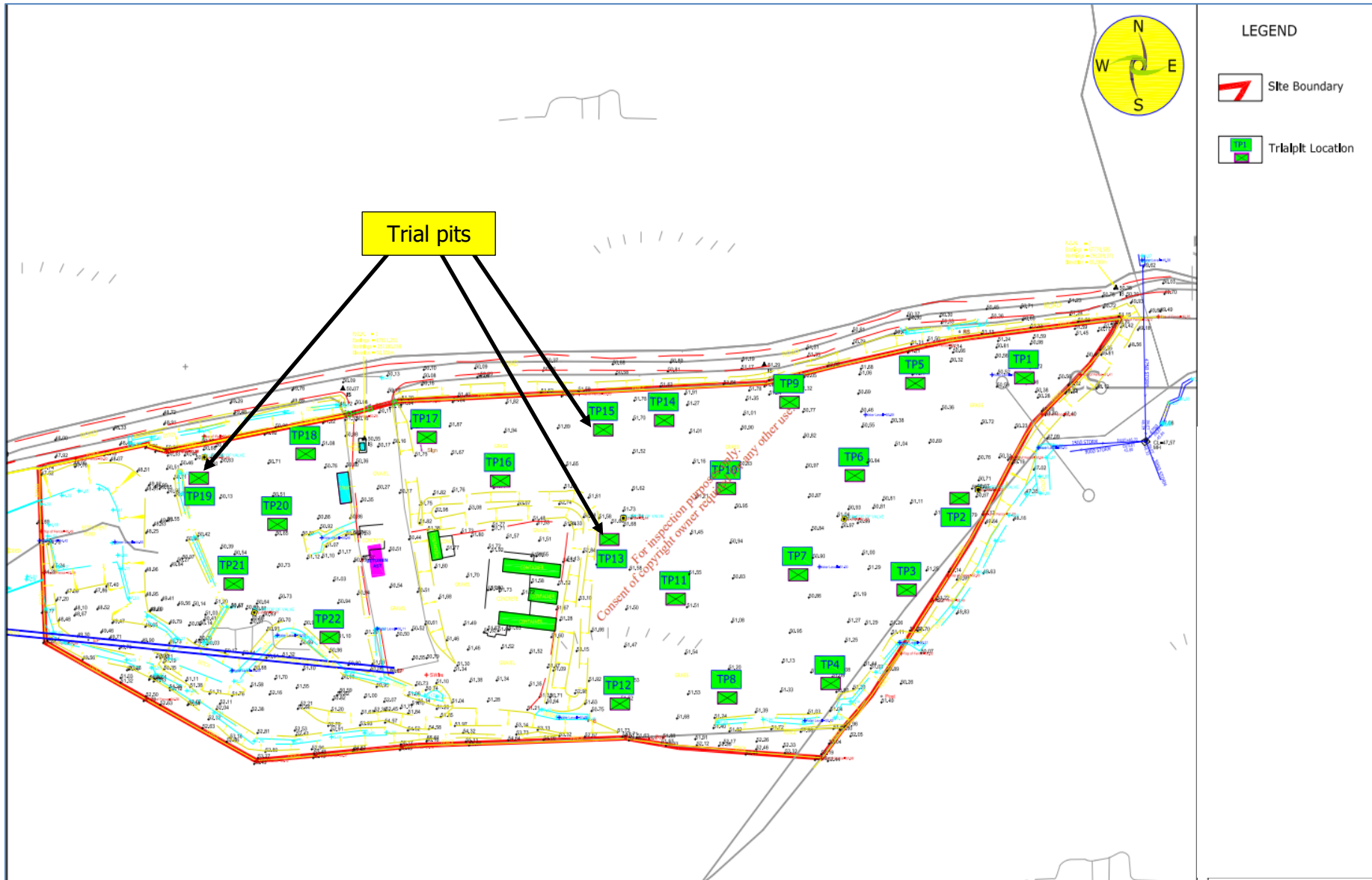


Figure 4: Trial pit locations (TP)

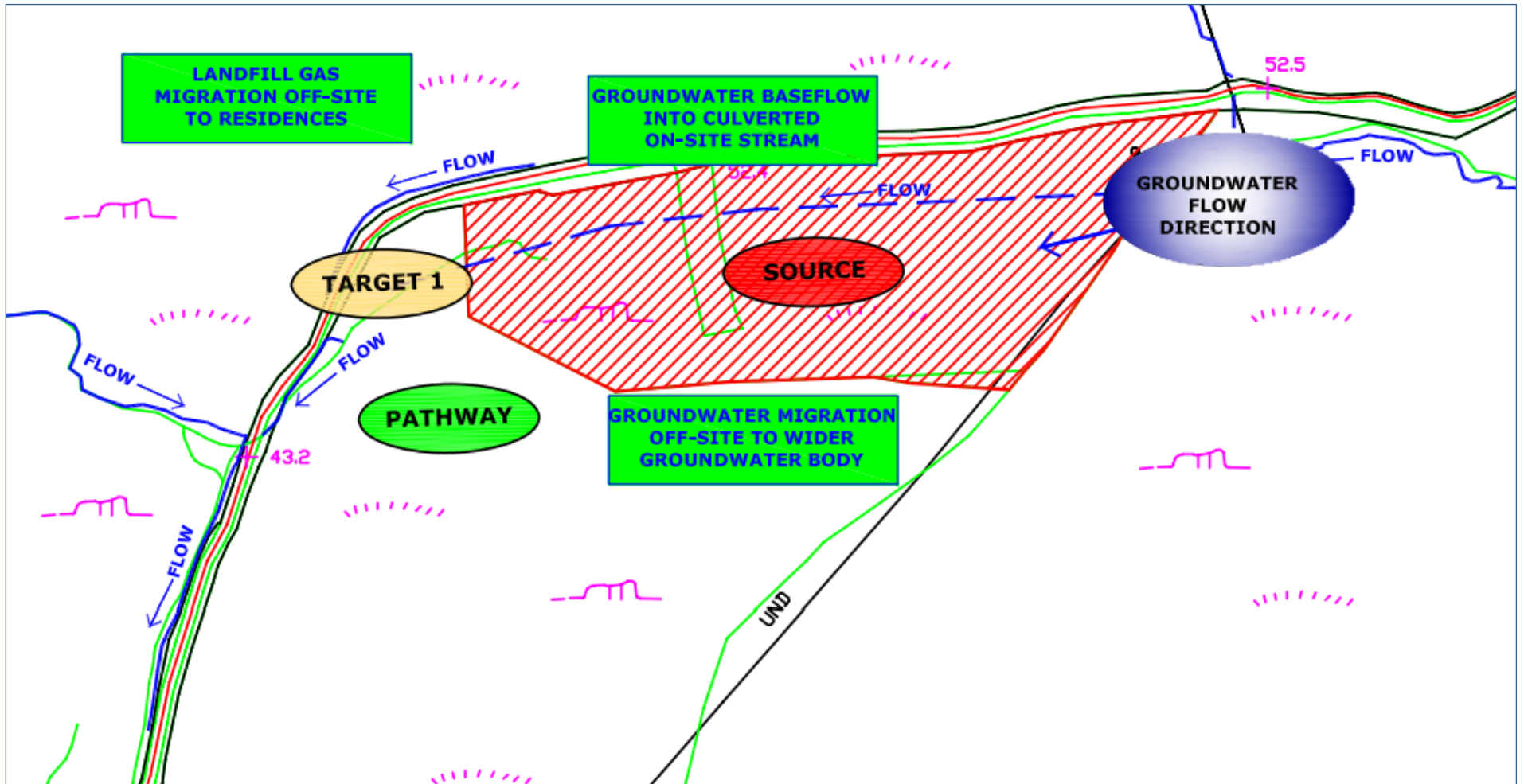


Figure 5: Conceptual site model for Tullyvogheen Historic Landfill

**Appendix 1: Assessment of the effects of activity on European sites and proposed mitigation measures.**

European Site	Direction from the facility (km)	Qualifying Interests (* denotes priority habitat)	Conservation Objectives	Assessment
The Twelve Bens/Garraun Complex SAC (site code: 002031)	0.6km south from the site.	<p><b>Species:</b></p> <p>1029 Freshwater Pearl Mussel <i>Margaritifera margaritifera</i></p> <p>1106 Atlantic salmon <i>Salmo salar</i></p> <p>1355 Otter <i>Lutra lutra</i></p> <p><b>Habitats:</b></p> <p>1833 Slender Naiad <i>Najas flexilis</i></p> <p>3110 Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)</p> <p>3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea</p> <p>4060 Alpine and Boreal heaths</p> <p>7130 Blanket bogs (* if active bog)</p> <p>7150 Depressions on peat substrates of the Rhynchosporion</p> <p>8110 Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)</p> <p>8210 Calcareous rocky slopes with chasmophytic vegetation</p> <p>8220 Siliceous rocky slopes with chasmophytic vegetation</p>	<p>NPWS (2017) Conservation Objectives: The Twelve Bens/Garraun Complex SAC 002031.</p> <p>Version 1. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs [dated 25<sup>th</sup> July 2017].</p>	<p>Although there will be no emissions from the landfill site to surface water or groundwater, there is a potential risk of migration of landfill leachate into surface waters and groundwater. However, the appropriate capping, as required under Condition 3.1, will limit ingress of rainwater into the waste body thus limiting the generation of leachate.</p> <p>Condition 3.9 and Schedule A require monitoring, sampling, analysis and characterisation of leachate, groundwater upgradient and downgradient of the waste body and surface water upstream and downstream of the landfill.</p> <p>Additionally, Condition 3.1 requires installation of a gas venting system.</p> <p>Condition 3.9 and Schedule A require gas monitoring from the gas vent pipes.</p> <p>Furthermore, Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>The controls in the recommended certificate of authorisation will ensure that the qualifying interests of this European site will be protected.</p>

		91A0 Old sessile oak woods with <i>Ilex and Blechnum</i> in the British Isles		
West Connacht Coast SAC (site code: 002998)	7km west from the site.	<p><b>Species:</b></p> <p>1349 Common Bottlenose Dolphin <i>Tursiops truncatus</i></p>	<p>NPWS (2015) Conservation Objectives: West Connacht Coast SAC 002998.</p> <p>Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 2<sup>nd</sup> November 2015].</p>	<p>Although there will be no emissions from the landfill site to surface water or groundwater, there is a potential risk of migration of landfill leachate into surface waters and groundwater. However, the appropriate capping, as required under Condition 3.1, will limit ingress of rainwater into the waste body thus limiting the generation of leachate.</p> <p>Condition 3.9 and Schedule A require monitoring, sampling, analysis and characterisation of leachate, groundwater upgradient and downgradient of the waste body and surface water upstream and downstream of the landfill.</p> <p>Additionally, Condition 3.1 requires installation of a gas venting system.</p> <p>Condition 3.9 and Schedule A require gas monitoring from the gas vent pipes.</p> <p>Furthermore, Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>The controls in the recommended certificate of authorisation will ensure that the qualifying interests of this European site will be protected.</p>
Slyne Head Peninsula SAC (site code: 002074)	7km south-west from the site.	<p><b>Species:</b></p> <p>1349 Common Bottlenose Dolphin <i>Tursiops truncatus</i></p> <p><b>Habitats:</b></p>	<p>NPWS (2015) Conservation Objectives: Slyne Head Peninsula SAC 002074.</p> <p>Version 1. National Parks and Wildlife Service, Department of</p>	<p>Although there will be no emissions from the landfill site to surface water or groundwater, there is a potential risk of migration of landfill leachate into surface waters and groundwater. However, the appropriate capping, as required under Condition 3.1, will limit ingress of rainwater</p>

	<p>1150 Coastal lagoons*</p> <p>1160 Large shallow inlets and bays</p> <p>1170 Reefs</p> <p>1210 Annual vegetation of drift lines</p> <p>1220 Perennial vegetation of stony banks</p> <p>1330 Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)</p> <p>1395 Petalwort <i>Petalophyllum ralfsii</i></p> <p>1410 Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>1833 Slender Naiad <i>Najas flexilis</i></p> <p>2110 Embryonic shifting dunes</p> <p>2120 Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes)</p> <p>21A0 Machairs (* in Ireland)</p> <p>3110 Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)</p> <p>3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.</p> <p>4030 European dry heaths</p> <p>5130 <i>Juniperus communis</i> formations on heaths or calcareous grasslands</p> <p>6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites)</p> <p>6410 <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)</p> <p>6510 Lowland hay meadows (<i>Alopecurus</i></p>	<p>Arts, Heritage and the Gaeltacht [dated 5<sup>th</sup> February 2015].</p>	<p>into the waste body thus limiting the generation of leachate.</p> <p>Condition 3.9 and Schedule A require monitoring, sampling, analysis and characterisation of leachate, groundwater upgradient and downgradient of the waste body and surface water upstream and downstream of the landfill.</p> <p>Additionally, Condition 3.1 requires installation of a gas venting system.</p> <p>Condition 3.9 and Schedule A require gas monitoring from the gas vent pipes.</p> <p>Furthermore, Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>The controls in the recommended certificate of authorisation will ensure that the qualifying interests of this European site will be protected.</p>
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Connemara Bog Complex SAC (site code: 002034)	1.7km south from the site.	<p><b>Species:</b></p> <p>1106 Salmon <i>Salmo salar</i></p> <p>1355 Otter <i>Lutra lutra</i></p> <p><b>Habitats:</b></p> <p>1065 Marsh Fritillary <i>Euphydryas aurinia</i></p> <p>1150 Coastal lagoons*</p> <p>1170 Reefs</p> <p>1833 Slender Naiad <i>Najas flexilis</i></p> <p>3110 Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)</p> <p>3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto-Nanojuncetea</p> <p>3160 Natural dystrophic lakes and ponds</p> <p>3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation</p> <p>4010 Northern Atlantic wet heaths with <i>Erica tetralix</i></p> <p>4030 European dry heaths</p> <p>6410 <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)</p> <p>7130 Blanket bogs (* if active bog)</p> <p>7140 Transition mires and quaking bogs</p> <p>7150 Depressions on peat substrates of</p>	<p>NPWS (2015) Conservation Objectives: Connemara Bog Complex SAC 002034.</p> <p>Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht [dated 28<sup>th</sup> October 2015].</p>	<p>Although there will be no emissions from the landfill site to surface water or groundwater, there is a potential risk of migration of landfill leachate into surface waters and groundwater. However, the appropriate capping, as required under Condition 3.1, will limit ingress of rainwater into the waste body thus limiting the generation of leachate.</p> <p>Condition 3.9 and Schedule A require monitoring, sampling, analysis and characterisation of leachate, groundwater upgradient and downgradient of the waste body and surface water upstream and downstream of the landfill.</p> <p>Additionally, Condition 3.1 requires installation of a gas venting system.</p> <p>Condition 3.9 and Schedule A require gas monitoring from the gas vent pipes.</p> <p>Furthermore, Condition 3.3 requires that the closed landfill and the remedial works shall not cause environmental pollution or deterioration in the status of the receiving surface water body or groundwater body.</p> <p>The controls in the recommended certificate of authorisation will ensure that the qualifying interests of this European site will be protected.</p>



		the Rhynchosporion 7230 Alkaline fens 91A0 Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles		
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